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ABSTRACT

A representative sample of current research investigating ecological variables in classrooms is reviewed in this paper. Empirically-based recommendations for classroom arrangement and suggested areas of research which might be beneficial to the development of prescriptive guidelines for preschool classrooms for handicapped children are provided. The content of the review has been organized into five major divisions: (1) adults in the classroom, (2) the grouping of children within the classroom, (3) architectual variables, (4) scheduling, and (5) arrangement of materials in the classroom. It is concluded that, in general, current research recommendations for facilities for handicapped children do not appear to be based on empirical findings about effects of environmental variables on child or teacher behavior. It is argued that programatic research in this area is needed to better define the effects of teacher/child ratios, material choice and arrangements, child groupings, scheduling, and architectural arrangements on the behavior of handicapped children in preschool classrooms. (Author/MP)

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THE PHYSICAL ECOLOGY OF PRESCHOOL CLASSROOMS FOR THE HANDICAPPED

A SELECTIVE REVIEW OF LITERATURE

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Optimal arrangements of the physical and social components of classrooms for handicapped children has been a continuing concern of educators and allied practitioners (Guralnick, 1978). Much effort has been directed toward design and implementation of physical environments to facilitate the education and care of these children (cf. Spivack, 1974; Evans, 1972), however, only limited research has documented the effects of physical variables on the behavior of persons in these settings. Most often, it appears that the selection of classroom design (arrangement of physical components, scheduling, teacher-child ratios, etc.) has been based on the "folklore" of teachers, the informal knowledge acquired through experience with children, or on the limits imposed by the particular situation (size of room, availability of equipment, funding for staff, school scheduling requirements).

Recent right to education laws and the resulting trends towards mainstreaming and preschool education for the handicapped have emphasized the need for prescriptive guidelines for arranging therapeutic learning environments for young handicapped children. Federal, state, and local health requirements (e.g., Regulations for Licensing Child Care Centers, 1977) provide minimal guidance by regulating size of classrooms, playgrounds, sanitation conditions, and minimum numbers of teachers. However, within the confines of these regulations, no direction is offered toward creating environmental arrangements which are comparatively more supportive to child and teacher.

The purpose of this paper is to review a representative sample of current research investigating ecological variables in classrooms in order to make empirically-based recommendations for classroom arrangement and to suggest areas of research which might be beneficial to the development of prescriptive guidelines for preschool classrooms for handicapped children.

Overview of literature reviewed

Research and supporting literature which might contribute to the formulation of prescriptions for preschool handicapped classroom environments is not readily available from any single discipline. Four focal areas of literature have been identified:

1) Traditional ecological studies. These investigations examine the behavior of children in classrooms as a function of naturally occurring changes in the environments. No formal research design is employed although statistical analyses of effects are common. Subjects are observed in a setting or settings they typically frequent. Emphasis is placed on behavior patterns of the group of children as a function of the particular environment or activity setting.

2) Behavioral ecology studies. Investigations employing two or more experimental conditions to investigate the effects of environmental events on the behavior of children in classrooms or group care settings were placed in this classification. Generally, these studies examine fewer variables than the investigations in category 1 which focus on the stream of behaviors exhibited by the subjects.

3) Behavioral and ecological studies with handicapped children. Research reporting investigations of the effects of physical classroom variables on the behavior of young handicapped persons was considered in this area. In a few cases, reports were classified in either area 1 or 2, and in area 3 because the reports considered both normal and handicapped

populations.

4) Prescriptive articles. Reports which did not contain data-based investigations, but did suggest guidelines for environmental arrangement of classrooms were reviewed and considered under this heading.

Definitions

Ecology. Ecology is a term shared by psychologists, sociologists and educators (cf. Auerswald, 1969; Barker, 1964; Michaels, 1974; Wahler, 1972), yet there is little agreement concerning its precise definition. While those interested in ecology share some overlapping tenets, there is little homogenity among writers (Holman, 1977). The term "human ecology" emerged as a sociological concept sharing ties with the systemics model of plant and animal ecology (Theodorson, 1961) and was modified by Barker and his colleagues (Barker, 1968; Gump, 1971; Barker & Schoggen, 1973; Wright, 1967) to focus on behavior settings and their impact upon the behavior of persons in those settings. Currently, the term is used by psychologists studying human behavior in at least two ways. One use of the term referes to the system of intrapersonal behavior in which the subject is viewed as demonstrating a complex of interrelated behaviors, and changes in one behavior may result in changes in other behaviors (cf. Willems, 1977; Wahler, 1977). A second use of the term focuses on the subject within the physical milieu (Gump, 1977; Risley, 1977). Here it is argued that the arrangement of the setting influences the subject's behavior. The second definition is one closely aligned to Barker's conceptualization of the term and the definition used throughout this paper.

Physical Ecology. The ecology or environment of the classroom includes both physical and social dimensions; however, this discussion will be limited to the physical components of group instructional settings. These variables include walls; furnishings and their arrangements; academic and recreational activities and materials, and their scheduling and number; and persons present, and their number and arrangement. Included in this consideration of physical ecology are variables such as sequence of activities, numbers of teachers present (but not their specific behaviors), seating arrangements of children, accessibility of materials, arrangement of furniture, placement of barriers and materials in the classroom space. Arrangement of academic materials for teaching specific skills will not be reviewed here. Curriculum content, social interaction, teacher variables (style, reinforcement, instructions) and composition of student enrollment (example, ratios of handicapped to nonhandicapped children) have not been evaluated in this paper, although their importance in the total classroom ecology clearly is recognized. The contingency milieu (the presence of reinforcing and punishing events and their relationship to child behavior) also comprises an important aspect of the classroom environment, but is discussed here only in terms of its relationship to the physical setting.

The reviewed literature was limited to studies or reports describing classroom or child care settings. Although a few studies were carried out in simulated classroom situations, an attempt has been made to draw primarily from findings based on actual classroom observations. Because the research describing physical aspects of preschools for handicapped children is extremely limited, much of the literature cited refers to normal preschool children. Also, due to the limited research in this area, a few studies examining the effects of physical classroom variables with

with older children have been described where it appeared that these studies were relevant to the overall focus of the review.

The content of the review has been organized into five major divisions coinciding with the primary areas of research on classroom environments.

These areas include:

1) Adults in the Classroom: the effects of variation in number and placement of teachers and caregivers in the preschool and early childhood learning centers

2) Child Arrangements: the effects of number of children and their arrangement within the classroom

3) Architectural Variables: the effects of lighting, open vs. closed arrangements, cubicles for academic learning, and general building dimensions and arrangement

4) Scheduling: the effects of varying arrangements of activities within the preschool day

5) Arrangement of Materials in the Classroom: considerations of accessibility of material and their display, the type and number of materials available.

Adults in the Classroom

The adult, a teacher, aide, or caregiver in the preschool classroom may be the single most influential ecological variable (Houston-Stein, Friedrich-Cofer, & Susman, 1977), as it is this person who is largely responsible for determining all other aspects of the environment. The teacher selects materials, arranges them, determines the schedule, groups children and modifies environmental arrangements. These monitoring and selection activities, the type and degree of structure the adult imposes upon classrooms, and the style of adult teaching and social interaction will not be discussed specifically. However, the implicit importance of adult behavior is recognized and assumptions about the critical nature of adult influence prompt considerations of less complex variables, such as number of adults present and their location. If the behavior of adults

in the preschool classrooms was not relevant, the number and location of these persons would be of little consequence.

The role of adults in classrooms, typically teachers, has been a topic of interest to researchers (cf., Huston-Stein et al., 1977), educators (Read, 1960; Caldwell, 1967; Keister, 1970) and agencies responsible for child care and education (cf., Caldwell, 1969). The problem of providing adequate adult attention to children in group settings has been traditionally approached by recommending various staff/child ratios. In general, increases in staff/child ratios are suggested as the developmental age of the children in a facility increases (1:3 recommended for infants; 1:5 for toddlers, 1:10 for normal preschool children; 1:7 for mildly handicapped preschool children; and 1:4 for severely handicapped, Kansas Child Care Regulations, 1977, p. 20). However, there is little empirical evidence of the effects of staff/child ratios in either caretaking or therapeutic settings for normal or handicapped young children.

Studies with handicapped populations are particularly lacking. Although a few investigators have examined the effects of number of ward staff on the behavior of institutionalized populations (see Berkson & Landesman-Dwyer, 1977), recent literature contains only one such investigation with handicapped children in preacademic settings. Frankel and Graham (1976) observed a group of six retarded children and a group of six autistic children in preacademic teaching sessions when teacher/child ratio was either 1:1 or 1:3. No significant differences in child attention and on-task behavior were found. However, the results may have been confounded by differences in tasks during the two ratio conditions. Further, the division of each 20-min. session into 3-min. segments with evaluation

of different tasks, ratios of teachers, child groupings and reinforcement, may not have allowed sufficient evaluation of any single variable.

Several studies have examined effects of teacher or staff ratios with normal children in group care and preschool settings. Since each of these studies has been done in different types of settings, there is relatively little empirical evidence for any single type of child population or setting.

In an investigation of dependency and social behaviors of normal preschool children in graded and ungraded classrooms, O'Connor (1975) reported that in the setting with more adults present (adult/child ratio of 1:3.5), children interacted significantly more with adults than with children, and made more frequent bids for adult attention than children in the setting with fewer adults (adult/child ratio of 1:7). These results should be viewed with caution, however, since a second variable, composition of child groups (graded vs. ungraded) coincided with the differences in teacher/child ratios. Although differences in levels of child/child and child/adult interaction were seen between the groups having different teacher/child ratios, no clear advantage or disadvantage was observed in either group. O'Connor suggests that a balance between extremely high and low teacher/child ratios is perhaps the safest and most feasible.

In an experimental study investigating the effects of teacher presence on activity selection and duration of attendance in activities, Hursh (1972) found that presence of a single teacher was critical to attracting 2 1/2-to-3-year-old children to an area. Effects of different numbers of teachers were not investigated. In a comprehensive study of children's activities in preschools, Stodolsky (1974) reported teacher/child ratios significantly influenced duration of children's activities and rate of transitions. In the four preschools studied, higher numbers of adults

consistently resulted in shorter periods of activity and more transitions. The strongest effects were seen with the youngest children, and in a longitudinal sample of the children's behavior (spanning two years), the effect of child/staff ratios appeared to decrease as children aged.

Investigations in group care settings for infants and for infants and preschoolers (Haskins, 1974; Cataldo & Risley, 1974; LeLaurin & Risley, 1972) consistently suggest that number of staff present may not be as critical as the careful placement of staff and assignment of staff to specific activities. Haskins (1974) investigated the effects of number of staff on interactions with infants in a group care setting and determined that staff efficiency in terms of time spent interacting with the children decreased from 75% to 45% as number of staff increased from one to four persons per area when staff were not assigned specific activities. Haskins subsequently demonstrated that planning specific activities was a more effective means of engaging children in interactions than increasing number of staff and that staff efficiency was relatively high for all numbers of staff during such activities. Similar findings were reported by Cataldo and Risley (1974). A study by LeLaurin and Risley (1972) evaluated the assignment of staff to specific activities or "zones" with preschool children in a community-based daycare program. They found that zone assignments were more efficient for both teachers (more opportunities for teachers to interact with a larger number of children on more teaching-oriented topics) and for children (less waiting time between activities and fewer disruptions).

In summary, the limited research available seems to suggest that (1) small teacher/child ratios are not necessarily the best arrangement for the children in a group setting; (2) if the desired result is a high level

of child/child interaction, a smaller number of teachers may be preferred; (3) large numbers of staff do not necessarily provide better care to the children; and (4) providing specific activities increases the likelihood that any number of staff members will interact more frequently with the children.

Adults in the classroom serve another function which merits consideration in this context. The behavior of adults has been shown to be an effective tool in compensating for an undesirable environmental arrangement. Studies by Krantz and Risley (1978), and Montes and Risley (1975) systematically demonstrated that changes in contingencies of adult reinforcement were sufficient to alter children's behaviors in arrangements which had previously been shown to be the least desirable of two comparison conditions. Research by Kounin and Gump (1974) further supports this premise. In a study of 596 lessons prepared and taught by 36 teachers, they determined that teacher style of presentation and the cues implicit in this style were stronger, more consistent determinants of child behavior than the activity or material involved. While properties of the activity setting function to mold the behavior of participants, teachers can and do use particular teaching techniques to modify the effects of other setting variables.

Child Arrangements.

The number of children in classrooms has been a traditional concern of educators (cf. Wolf, 1967). Guidelines are provided for maximum numbers of children in preschool and daycare centers (Regulations for Licensing Child Care Centers, 1977, p. 20) with different recommendations for older and young children (infants: 9; toddlers: 10; 3 to 4 year olds: 20) but no additional recommendations for children with various handicaps.

Typically, the suggested numbers are presented with some requirements for minimum space per child. Although the premise of requiring certain minimal space seems to be well-founded in ecological research (Sommer, 1969), little research has investigated the effects of different sized groupings of children within classrooms.

An early study by Dawes (1934) evaluated 433 children in kindergarten classes ranging in size from 14 to 46 pupils. In each classroom, children sat in desks fixed to the floor. Group size had essentially no effect on recall scores of the children who were tested after a story presentation. However, group size did affect the mean number of remarks per child during discussions with larger groups producing fewer remarks per child. Children sitting nearest the teacher presenting the story and asking questions contributed significantly more remarks to the discussion than children sitting in the back of the room.

The study by Frankel and Graham (1976) discussed earlier may also have implications for the size of groupings of retarded and autistic children. Within the context of relatively small preacademic groups, no change in academic behavior or disruptions was seen when children worked alone with a teacher or in groups of three with a teacher.

Barker and Gump's (1964) study of high school students attending large and small schools suggests a principle which may be extended to groups of younger children. In their research, they found that small schools generally offered fewer behavior settings, but that more students had opportunities to participate in these settings. As setting size increased, students participaed in fewer activities. In classrooms for handicapped children, it may be important to insure that all children have opportunities to participate in each activity that is offered. If

Barker and Gump's premise is valid within relatively small settings (classrooms) as it was across larger settings (whole schools), then small classrooms and groupings of children would seem to be the correct recommendation. Certainly, this is an area of ecological investigation which would merit further research.

Density is a particular aspect of groupings of children in preschools which has received considerable research (Wolfe, 1975; Smith, 1974). It appears that children's behavior is influenced more by the manner in which given levels of density are achieved than by the level of density itself. Children in nursery school settings move closer to one another (McGrew, 1970) and will show less aggressive behavior (Loo, 1972) when density is created by decreasing the total space available while maintaining a constant group size. On the other hand, they will maintain physical distance from one another (McGrew, 1970) and show increased aggression and decreased social interaction (Hutt & Vaizey, 1966) when group size is increased, but the total amount of space remains constant. Fagot's (1977) observations in three Dutch and two American preschools found that positive social interaction and task behaviors of 4-year-olds were quite similar in classrooms of varying densities (1.6 m^2, 2.33 m^2 and 10.66 m^2 per child). While higher density does not necessarily produce negative behavior in young children, it may require teachers to adapt more directive teaching styles and more careful planning for activities. In the more crowded schools, Fagot reported a higher degree of teacher regulation and less allowance for individual's spontaneity.

Within classrooms, the physical placement of children for particular activities has been shown to have an effect on their behavior. Krantz and Risley (1978) analyzed the on-task behavior of eight children in a

supplemental kindergarten-like classroom. During both story time and project demonstrating on-task was significantly higher when children were spaced equidistantly (on chairs or sitting in assigned spaces) than when they were allowed to crowd together (sitting on small rug). Contingent teacher praise was used to successfully modify the children's behavior during a subsequent crowded condition to resemble the degree of appropriateness achieved during the spacing condition. Eck (1975) reported that children were less disruptive during naptime in a daycare center when the cots were spaced and staggered so that children did not face each other. In this study, teacher attention was shown to be less effective than environmental rearrangement in encouraging appropriate naptime behavior by toddlers.

The conclusions to be drawn from the small amount of research cited must be tentative ones: (1) spacing and arrangement of children for certain activities appears to facilitate appropriate behavior, and (2) relatively larger groups may not decrease certain appropriate academic behaviors.

Architectural Variables

Recently, there has been a renewed interest in behavioral architecture and engineering (Danford, 1976). However, the physical environment (room size, lighting, selection and arrangement of furniture, etc.) has consistently received attention from educators (Read, 1960; Hildebrand, 1976; Todd & Heffernan, 1967; Dales, Skipper, & Witherspoon, 1967; Hewes & Hartman, 1976) prescribing optimal preschool environments. Literature relevant to considerations of architectural variables takes several forms: research reports, observational-anecdotal reports, strategy and position papers. For the purposes of this review, papers of several types have been

grouped together under the variable which they consider. Although there is more literature in this topic area than the others considered in this paper, there is relatively limited research on most variables and with the exception of reports of lighting effects, almost no research has been done with handicapped populations.

Lighting

Recent studies (Painter, 1976; Ott, 1976; Arehart-Treichel, 1974; Coleman, 1976) have investigated the effects of fluorescent light on the activity level of young children. None of the studies is well controlled, and therefore, the results should not be considered conclusive. The study by Painter (1976) used teacher definitions and measurement of "hyperactive behaviors" to compare the differences in nine emotionally disturbed children's behavior with fluorescent and incandescent lights in the classroom. In the studies reported by Ott (1976) and Arehart-Treichel (1974), cameras mounted in the ceilings recorded sequences of time-lapse pictures of four regular first grade classrooms illuminated either by regular fluorescent or full spectrum fluorescent lights with lead foil shields wrapped around the cathode ends of the tubes. This was to stop suspected soft x-rays they felt contributed to hyperactivity. Although none of the studies presents comprehensive data analysis, all report that standard fluorescent lights had an adverse effect on the activity level of the children. The Painter (1976) study reported significantly more hyperactive incidents with fluorescent lights. Coleman (1976) reported six autistic preschoolers spent significantly more time engaged in repetitive behavior under fluorencent light. These studies offer a preliminary look at an environmental variable which may have an impact on many children in normal and special classrooms, and suggest that more rigorous investigations should

be carried out in regard to lighting and its effects.

Open-space environments.

"Open"[1] classrooms have received considerable attention during the last few years (Traub, Weiss, Fisher & Musella, 1972; Kohl, 1969; Rathbone, 1972) Most research in this area has focused on normal children in primary and secondary schools. The following general observation of the effects of open-space classrooms have been offered:

1) Open architecture does not necessarily coincide with open programs; relatively traditional teaching practices often exist in schools of open design (Gump, 1974, Fisher, 1974).

2) Open-space schools do not consistently insure that students will work in smaller groups or receive more individualized teacher attention (see conflicting results reported by Gump, 1974, and by Fisher, 1974, however).

3) There appear to be no significant differences in academic achievement between students in open-space and traditionalally designed schools (Brunetti, 1971).

Only one study of handicapped children in open-space school settings was found. This study focused on the social effects of integrating EMR's with normal students. Gottlieb and Budoff (1973) compared the social position and acceptability of integrated and segregated EMR children in a traditional school building with those of EMR children in a no-interior-walls school. The results indicated that retarded children in the unwalled school were rejected more than either segregated or inter-

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[1]The term "open" is used in two ways to denote architectural and programmatic variations in education. "Open-space" referes to an architectural concept in which several classes and teachers meet in a large area, usually without walls. The concept of "open" education refers to a variety of practices that included self-directed learning and a humanistic attitude toward the student. The focus in this paper is only on architectural openness.

grated children in a traditional building. Although these results are consistent with other studies of intergration versus segregation (Gampel, Harrison, & Budoff, 1972; Goodman, Gottlieb, & Harrison, 1972), one study is not sufficient basis for a clear conclusion about the effects of open-space architecture.

Twardosz, Cataldo, and Risley (1974), reported a series of studies designed to empirically test the validity of an open environmental design for toddler and infant daycare. After observing children and staff in two comparison conditions (ABAB design), it was determined that an open environment (no walls; low dividers and furniture used to demarcate activity areas) markedly decreased the amount of time a child could not be seen by an adult, and the amount of time staff members' activities were not visible to the supervisor. A second experiment demonstrated that infants and toddlers slept just as well in an open environment as they did in a dark, closed room. The third experiment showed an open environment to be as conducive to small group preacademic tasks with toddlers as placing the groups in separate rooms. The effects reported in these investigations were quite clear and particularly the results in the third experiment appear to have implications for settings with handicapped children who might have similar attention spans and skills as the 18- to 30- month-old children studied.

Another study of the effects of open-space classrooms which may have potential implications for special preschool classrooms was conducted by Reiss and Dyhdate (1975). Using a post-test only design, they evaluated the effects of open-space classrooms on persistence and achievement by 30 second graders. Their general conclusion was that children who learn persistence in open-space environments do quite well, scoring higher on achi-

evement tests and showing greater persistence at new tasks than children in traditional classrooms. Children who are not persistent in open environments, however, score much lower than any of the children in traditional settings. This finding may have particular implications for handicapped children who exhibit lower rates of attending and on-task behavior than normal children, but specific evaluation of academic performance by handicapped children in open-space schools has not been done.

Restricted environments as an alternative to regular classroom arrangements.

The use of cubicles as an aid to increase attending by certain types of handicapped children has been suggested. Strauss and Lehtinen (1947) first suggest cubicles for academic activities of brain injured children. Cruickshank, Bentzen, Tazeburg, and Tannehauser (1961) make a similar recommendation for hyperactive children. Haring and Phillips (1962) have suggested that emotionally disturbed children might work better in such restricted environments. The logic underlying the use of study booths to facilitate learning is based on observations that atypical children seem to overreact to irrelevant stimuli in their environments and that these overreactions interfere with study behavior. In general, however, the research does not demonstrate that the use of cubicles will facilitate learning. Cruickshank et al. (1961) found no significant differences in academic achievement by brain injured children in experimental groups (using study booths) and in control groups. Haring and Phillips (1962) did show significant effects in a multivariate analysis of their data. However, the use of cubicles was combined with the manipulation of many other classroom variables, and the specific effects of the cubicles was difficult to ascertain. Two studies (Rost & Charles, 1967; Shores & Haubrich, 1969) which used more tightly controlled single subject designs found no significant effects on academic performance. However, the Shores

and Haubrich (1969) study reported a small (10%) but statistically significant change in attending behavior by emotionally disturbed children. Cubicles or other restricted settings may be of some help in the initial steps of teaching children, particularly when attending behavior is being shaped; however, cubicles alone do not appear to positively affect actual academic performance.

Studies by Tizard (1968) and by Gardener, Cromwell, and Foshee (1959) strengthen the argument that restricted environments may not be particularly beneficial in limiting inappropriate behaviors in retarded (Tizard) and hyperactive (Gardener et al.) children. Tizard (1968) reported observations of overactive children in rooms with toys and rooms without toys, and found no significant differences in movements classified as evidencing hyperactivity. Gardener et al. (1959) found that displays of visually stimulating objects (Christmas tree lights, party hats, beads, etc.) reduced the activity level of the 88 subjects they evaluated in high and low visual stimulation conditions. Because neither of these studies directly measured academic or appropriate prosocial behaviors, their implications for classrooms are somewhat limited. More extensive documentation of child behavior under similar experimental conditions would have added considerably to the strength of these investigations.

In general, there is little research evaluating the effects of architectural variables on young handicapped children. The correlative literature for children of other ages and abilities does not provide obvious prescriptions for younger, more limited children. Strong arguments for or against open or restricted environments cannot be offered on the basis of the limited, and somewhat contradictory, evidence. Physical variables, such as classroom arrangement, must be measured with careful attention to

other components of the classroom ecology. The studies investigating the effects of open and closed environments implicitly suggest that the effects of these variables are typically modified by the teacher's ability to manage the children and to impose a structure upon the classroom in general. Few studies have offered sufficient measurement of teacher behavior to isolate the role of the physical arrangement alone. Furthermore, much literature on limited environments may not be applicable to classrooms because neither of the conditions evaluated (highly restricted vs. highly distracting) is likely to occur in a classroom. The range of environmental complexity (limited vs. rich) is at least somewhat determined by the purpose of the setting, and thus, neither of the experimental conditions are probable.

The conclusions to be offered must be tenative ones: (1) open environments do not appear to be detrimental to the students who have learned to manage their behavior in such settings, and such environments may facilitate staff supervision of students (2) the relative effects of the physical arrangement (open vs. closed) interacts strongly with adult management of the setting, (3) restricted environments with limited stimuli to distract the child do not appear to have particular advantage over normally stimulating settings, and (4) fluorescent lighting may contribute to the display of certain types of undesirable behavior in children, however, the relative effect may be quite limited.

Scheduling.

The sequence in which classroom activities are arranged is an important part of the ecology of a learning setting. Ecological studies by Gump (1969, 1974) have suggested that the order of classroom events is a type of contextual setting and that activities may result in different behaviors depending

upon what precedes or follows them. While the ecologists have not offered specific data on this aspect of behavior settings, a few experimental studies have investigated alternative scheduling arrangements in preschool and grade school classes.

Krantz and Risley (1978) and Hawn, Holt, and Holmberg (1973) studied the effects of preceding activities on children attending in a large group type activity and found conflicting results. Krantz and Risley compared attending during a 15-min. story session when it was preceded by a) an active session followed by a transition activity, and b) an inactive session followed by a transition activity. Visual attendance to the teacher and the story were significantly greater when the story followed an inactive session. Disruptive behaviors were less frequent and transition time was shorter when the preceding activity was inactive. Introduction of descriptive praise and privileges during the transition and story time following active sessions produced greater visual attendance, less disruptions and shorter transition times.

Hawn et al. observe four normal children in a preschool during two conditions similar to those used by Krantz and Risley (1978). Attending in a group activity (story or movie) was compared when it was preceded by either outside play or table activities (puzzles, manipulative, or conceptual games). The results indicated that the children were less attentive in large group when a quiet activity preceded it than when an active activity preceded it. Because both studies seem to be methodogically sound and the definitions of behavior comparable, the results are surprising. It is possible that the subject populations were sufficiently different (Krantz & Risley's subjects were inner-city children in a community daycare setting; Hawn et al.'s were children enrolled in a university preschool) to produce

different findings. Also, the difference in location of the active activities (inside in the Krantz & Risley study; outside in Hawn et al.) may have been an important variable. Such a discrepancy in results certainly merits further investigation.

Another aspect of scheduling is the number of activities simultaneously available to children and the conditions for moving among the activities. Doke and Risley (1972) measured and compared preschoolers participating in activities during two daily schedules. In the first schedule (Condition 1), several activities were available at one time and the children had the option of moving from one to another freely. In the second schedule (Condition 2), the activities were sequenced so all children participated in one activity and then moved to the next activity. A variation of the second schedule (Condition 3), required all children to wait until everyone finished the first activity then to move as a group to the second activity. Particpation levels were equally high during the first two conditions which allowed individual children to move to another area when they had finished their activity and cleaned up. When the children were required to wait after each activity until the group was ready to move "en masse," participation levels decreased considerably. These findings coincide with those in an earlier study (LeLaurin & Risley, 1972) with toddlers. When children moved in groups of 6-12 with a teacher assigned to each group, the percentages of child participation in activities was much lower than when teachers were assigned to zones (bathroon, lunch table, puzzles, etc.), and the children allowed to move from one activity to another as soon as they completed an activity.

Eck (1974) evaluated daycare procedures for nap times. As in the studies by Doke and Risley (1972) and LeLaurin and Risley (1972), allowing

children to leave the nap area individually was more efficient in terms of actual time sleeping and number of disruptions, than having the group wait and leave together. The consistency of these findings with children ranging from 18 months to five years would seem to suggest that scheduling activities to allow children to move from one area to another as they complete a given activity is desirable.

Only one study examining the effects of scheduling on handicapped populations was found. Frederickson and Frederickson (1977) compared fixed schedules with random schedules for 12 daily activities. During fixed scheduling, the 12 tasks were presented in the same order each day. During the random scheduling conditions, the first 10 activities were presented in a different, predetermined random schedule each day. For the 11 TMR students, task completion was lower during random conditions and rates of disruptions increased. Students with the lowest levels of appropriate behavior showed the greatest losses in task completion and the largest increases in disruptions. The results of this study are quite clear. However, it seems unlikely that random scheduling would be used in any classroom.

Arrangement of Materials in the Classroom

The materials children have available to them may be an important variable in classrooms, particularly to the extent setting events affect their academic and social behavior. The consistency of preschool children's behavior across situations containing the same materials or activities has been reported by several authors (Rosenthal, 1973; Kounin & Gump, 1974; Rose, Blank, & Spalter, 1975).

Most investigations during the 1930's focused on the effects of play materials on preschool children's activities (cf. Slater, 1939; Hulson, 1930; Updegraff & Herbst, 1933; Van Alstyne, 1932). Many current recommend-

ations for toys found in child development texts and parent guides (cf. Read, 1960; Hildebrand, 1976) seem to reflect the findings of these early studies. Generally, the investigations focused on play materials that produced greater or lesser degrees of social interaction among the children playing with them; however, the thorough study by Van Alstyne (1932) examined relative percentages of time spent with different materials, attention span with each material, frequency of choice, child stated preference and amount of participation with each material by 2-, 3-, 4-, and 5-year-olds. The results of Van Alstyne's study are complex because of the extensive nature of her measurements and the number of materials she examined, however, some general findings were:

1) For all ages, children seemed to prefer raw materials (materials that could be made into something to suit the child's puposes: blocks, clay, crayons and paper). Blocks were the most preferred material by children of both sexes at all ages.

2) There were differences in preference by sex and age, but generally not by intelligence or socio-economic background.

3) The majority (ranging from 70% to 90%) of time children spent playing was <u>not</u> spent in cooperative play. About 50% of the time children played alone; 20% - 30% of the time they engaged in parallel, non-cooperative play.

4) The materials most likely to produce passive cooperations were wagons, dishes, hollow blocks, assorted blocks, doll corners, colored cubes, dump trucks and parallel bars.

5) The materials most likely to result in child-child conversation were dishes, hollow blocks, doll corner, wagon, parallel bars, telephone, blocks, colored cubes, balls, crayons, and clay.

The trends in these findings have been verified on a more restricted scale by Shure (1963).

Quilitch and Risley (1973), and Quilitch, Christopherson and Risley (1977) have also examined children's preferences for toys and the type of behavior (primarily social or non-social) exhibited while playing with

these materials. These findings support earlier ones (Hulson, 1930; Van Alstyne, 1932) by demonstrating that children display consistent types of behavior with certain toys and some materials (for example, games which require several players) produce higher levels of social interaction than others which may be played with in isolation (for example, tinker toys).

In addition to the evaluation of materials, some consideration has been given to the type of activity. For example, Doke (1975) reported that children prefer and are more attentive in informal (settings in which children may obtain different materials and may use them in a variety of ways) activities than in formal (teacher led, with a single set of materials used in a particular way) activities. The use of formal activities may be necessary in handicapped classrooms, however Doke's findings suggest that arrangement of materials to allow for child choice could be a potentially important consideration.

Montes and Risley (1976) investigated the effects of toy arrangement on the duration of play by preschoolers. Use of toy boxes rather than shelves with manipulative toys reduced the amount of time children actually spent playing with the toys. With blocks and housekeeping materials, no significant differences in play time were seen between the two arrangements. Storing toys on shelves required much more child time for clean up, however. In a second study, limited and free access to toys were compared, and no difference in child play time were seen. The classroom teachers expressed a preference for the limited access conditions. Several other teachers and caregivers rated the play complexity during both conditions, and about 69% of the raters favored the limited access condition.

Two other aspects of material use have been reported on by Risley and

his colleagues. Doke and Risley (1972) found that relatively few materials could be offered in a single activity area, if children were permitted to go to other areas. Participation levels decreased when materials were removed only when children had no alternative activities to choose from. Krantz and Risley (1978) verified the importance of materials on child behavior by comparing the levels of disruption for eight children when all had worksheets to complete, and when only four had worksheets and the other four waited for materials. Disruptions were lowest when all children had materials. The subjects without materials were significantly more disruptive than those with materials. When descriptive praise for appropriate behavior was introduced, disruptions decreased markedly for all children, although the children without materials continued to have the highest disruption rates.

These studies demonstrating the consistency of normal children's behavior with toys would suggest that similar consistencies will be found with handicapped children. The severity and nature of the handicapping condition might, however, alter or limit the child's behavioral repertoire so that the normative data would not be predictive of an individual handicapped child's performance. The studies examining arrangements of toys (Montes & Risley, 1975) might also need further verification for handicapped populations, especially for populations with minimal motor skills. With such children, manipulating toys in a toy box and returning toys to shelves would be relatively more difficult tasks and therefore greater differences between alternative arrangements might be found.

Implications for Research

The current literature on the design of classrooms for young handicapped children and classrooms which integrate normal and handicapped

children is limited in both quantity and quality. Relatively few studies have been done, and those which are experimentally sound offer only limited prescriptions for the design of classrooms. A few variables (e.g., type of lighting) have been systematically analyzed, however, these limited analyses do not constitute a sufficient basis for general classroom guidelines for practitioners.

The research model forwarded by Risley and his colleagues seems to be a feasible one for further investigations. What is needed is programmatic research focusing on environmental arrangements common to classrooms for special populations. A series of investigations examining the numerous dimensions for the physical environment, rather than a few isolated studies, must be completed before empirically based recommendations to practitioners can be made. Replications across children of various ages and handicaps will be necessary for validating the recommendations.

Specifically, the following areas need further investigation:

Teacher/Child ratios. The limited investigations reported in this paper suggest that low teacher/child ratios are not helpful in generating child-child interactions, and may not be necessary in academic settings. Determining the most effective ratios will require better measurement of desired child behaviors (on-task, independent play, social interaction). It seems likely that there may be differences in optimal ratios depending upon the specific population and activity. For example, with deaf children displaying limited communicative compentency, small teacher/child ratios might be particularly desirable because such an arrangement would insure high rates of opportunities to interact with a communicative compentent person.

Child groupings. As in the case of teacher/child ratios, more thorough

measurements of desired behaviors (imitation, on-task, initiations, social interaction) are needed to evaluate the relative effects of different groupings of children. With the current emphasis on mainstreaming, research investigating the effects of mixing normal and handicapped children would be timely. Size of group and range of skill levels within groups merit further consideration as well.

Material choice and arrangement. Much research has focused on material usage and the resultant interactions by normal children. Comparison research with a variety of handicapped children would be useful. Arrangements of materials within classrooms should be evaluated with specific concern for children with handicaps which might interfere with their interacting with materials arranged in certain ways (e.g., piled in toy boxes, or on high shelves). Arrangements of materials might also be evaluated in terms of teaching potential and amount of teacher time required for distribution of materials.

Scheduling. The arrangement of activities within the daily schedule may have special implications for handicapped populations with typically shorter attention spans and fewer skills. Sequences of activities, transition styles, and individual versus group activities need consideration with children exhibiting differing handicaps.

Architectural arrangements. Variables such as lighting, color of room, and size of room have been postulated as important variables in human environments. Since many of these variables may be givens in child care settings, it seems more feasible to focus on components of the setting which can be rearranged by setting personnel. The issue of "open" versus "closed" classroom settings is perhaps too general for specific investigations, however, certain aspects of environments, such as the use of restricted

areas or separate rooms for preacademic activities, and dividing the room for specific activities rather than allowing one contiguous space might be examined for effects of both child performance and ease of teacher supervision.

Implications for Application

In general, the limited scope of research on environmental variables with handicapped children requires that any suggestions to the practitioner must be made with great caution. Most of the suggestions offered are based more on research with normal preschoolers than on specific examinations with handicapped populations.

The relative strength of ecological variables in modifying children's behaviors has not been empirically tested. Most studies have measured only a few primary physical variables and a few child behaviors. To evaluate the effects of physical ecological variables, the dynamic ecosystem of the classroom must be described and, ideally, quantified. The classroom is a system in which the physical arrangement of the room, available materials, children and their competencies, and adults and their compentencies continuously interact to form a unique environment. The relative contribution of any single variable is extensively modified by the configuration of other simultaneous or adjacent environmental and contingency variables.

Discrete environmental variables, if considered as part of the dynamic ecosystem, can influence the system, however. For example, the selection of play materials may have a moderate but direct effect on children's behavior. At the same time, materials may support or interfere with teacher monitoring of specific child behavior. Because the single variable (choice of materials) influences the child directly, and influences the teacher's behavior toward the child, the conjunctive or interactive impact of the variable may be greater than it would appear to be in an investigation

attempting to isolate the effects of the variable on certain child behaviors.

In the classroom, two populations are influenced by changes in social and ecological variables: the child population and the adult population. Any intervention directed toward child also will influence the adult. For example, arranging the daily schedule to provide continuous transition from one activity to another rather than having children wait until all have completed an activity before beginning the next activity, changes children's level of disruption by eliminating waiting and provides opportunities for teachers to observe and reinforce social interaction. Changing the physical environment may inadvertently change the social contingencies either between children or between teachers and children, and thus, a larger magnitude of effect may be evidenced.

If a general recommendation can be made to practioners, it is that powerful environmental variables are those which simultaneously affect both the adult and the child, and that support the general model of the classroom. For example, if peer interaction is a primary objective in a classroom, the conjunctive use of social materials, adjustment of teacher-child ratios, and arranging the room to provide areas for interaction will provide opportunities for display and support of the desired behavior. By altering the environment in several complimentary ways, the intended nuturance of social interaction is highly probable. Altering the environment so desired behavior can be noticed by teachers is as important as providing direct environmental support for the behavior.

Teacher preference may also play a role in determining the effects of environmental arrangements. When a teacher arranges a classroom, the arrangement reflects an environmental model that works for her. While the particular arrangment may not be ideal from an outside evaluator's point of

view, it has the distinct advantage of having been constructed by the person who uses the environment to achieve particular goals. Teacher preference need not define or limit the arrangement of a classroom, but it is an important consideration. An arrangement a teacher likes is much more likely to have the desired effect than one she does not find comfortable.

Child competency is an unexplored issue in ecological psychology, but it is of particular importance to persons constructing environments for handicapped preschoolers. The limited evidence available (cf., Stodolosky, 1974) suggests that younger or less skilled children will be affected most by changes in educational settings. More competent children may be able to adapt to any environmental configuration and behave appropriately under a variety of conditions. The accumulating evidence demonstrating a lack of generalization across settings (Stokes and Baer, 1977) would seem to suggest that setting variables may play an important role with minimally skilled populations. The literature with handicapped children is far too limited to allow more than speculation at this point, however.

The following suggestions are made with the caution that much additional research is needed to verify the effects of environmental variables on handicapped children. Specific selection of materials, teacher-child ratios, and other setting variables must consider the particular populations and the goals of the program the setting will support. No single material or arrangement will serve all programs equally well, and until a more complete research base is compiled for decisions, the choices must be made somewhat subjectively.

(1) Certain toys may be useful in encouraging social interaction. Building materials, dramatic play and games requiring more than one person have been shown to be consistently correlated with higher rates of social

play. Specific toys must be selected on the basis of children's skills. However, the use of certain classes of materials may be useful in supporting both child-child interaction and teacher prompts for interaction.

(2) Schedules that allow children alternatives and do not require children to wait for the group to finish an activity before individuals move on to other activities appear to be preferable since children can be nearly constantly engaged in activities.

(3) One-to-one teaching during preacademic and language learning periods is not necessarily preferable to small groups of children with a single teacher.

(4) Ideal ratios of teachers to children probably depends upon what specific child behaviors are desired. Low teacher/child ratios will reduce child-child interaction and will increase teacher-child interaction.

(5) Restricted settings with limited stimulus variability may not increase children's academic performance although increases in attending in such settings have been noted.

(6) The teacher is the single most important component of the child's academic environment. Research has shown that teacher attention can be used contingently to alter child behavior in a variety of less satisfactory environmental arrangements.

Conclusions

This paper has reviewed literature investigating the physical aspects of classrooms for young children. In general, the research directly relevant to designing classrooms for handicapped populations is limited. Current recommendations for facilities for handicapped children do not appear to be based on empirical findings about effects of environmental variables on child or teacher behavior. A programmatic research effort

is needed in this area to better define the effects of (1) teacher/child ratios, (2) material choice and arrangements, (3) child groupings (4) scheduling, and (5) architectural arrangements on the behavior of handicapped children in preschool classrooms.

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